ENVIRONMENTAL Fact Sheet

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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Water Efficiency Practices for Industrial Water Users

Many industrial processes are water intensive including washing and rinsing, heating and cooling, shop clean-up and outdoor water use. The water efficiency practices in this fact sheet address these industrial water uses. Employing these methods saves considerable water and water-related costs. Though seemingly costly to implement, investment payback on most water efficiency methods can be relatively short. A comprehensive audit and economic analysis should be performed to assess the facility's water system and identify locations where these practices can be employed to conserve water. See fact sheet WD-DWGB-26-16 "Performing a Business or Industry Water Use and Conservation Audit."

General Water Efficiency Practices

The following general water efficiency practices apply to all areas of the facility.

- Regularly check for leaks. Metering water uses throughout the plant helps detect leaks and maintain minimum flow rates.
- Sweep and shovel floors, loading docks, drives, parking lots and sidewalks rather than hosing down.
- Wash fleet vehicles less often.
- Use low-flow plumbing and equipment in bathrooms, cafeterias and other domestic areas.
- Turn off all water flows during shutdowns.
- Eliminate the need to purge hot water lines by installing on-demand point-of-use water heating systems.
- Reuse blow-down water in other applications. Blow-down or bleed-off from a cooling tower is the deliberate release of water containing high concentrations of dissolved solids that would affect the proper functioning of the cooling tower.
- Establish a routine maintenance program to routinely check and replace worn parts, tanks, and connections in water using and conveying equipment before leaks can occur.
- Upgrade to water-saving models as old equipment wears out.

Rinsing and Cleaning Water Efficiency Practices

The following water efficiency practices relate to the majority of rinsing and cleaning techniques. Many are specific to metal finishing and plating processes, some refer to aggregate washing and production, others refer to general cleaning practices.

- Clean products, equipment and the facility only when necessary.

- Utilize dry methods wherever possible. Compressed air or the brushing of surfaces rather than rinsing with water can be used for many types of cleaning processes.

- Install flow restrictors on plumbing fixtures to limit flow.

- Check nozzles for clogging.

- Install sensors or spring-loaded valves that shut off water flows when not in use.

- Use high pressure, low volume nozzles.

- Reclaim wash and rinse water. Reuse final rinse water in previous rinse or wash stages. Consider using dissolved air floatation, settling, filtration or centrifugation treatment techniques. All of these techniques are designed to separate solids from liquid. For instance, concrete manufacturers can recycle tailings and rinse water from the trucks into the production of concrete blocks.

- Switch to intermittent flow systems and use measured amounts of water rather than continuous rinsing and cleaning.

- Schedule similar processes together and use sequential rinses where water from one process is reused in the next. For instance, schedule color related processes from light to dark to reduce interim cleaning needs.

- Utilize air injection or mechanical mixers to improve rinse efficiency.

- Use air knives and wetting agents to reduce drag-out. Air knives use air streams to remove excess plating solution. Wetting agents reduce surface tension causing the plating solution to flow easily and cover the work piece more completely.

- Allow drag-out to drain completely before moving to the rinse process. Install drain boards to divert drag-out back to the process tank as the product moves to the rinse tank.

- Utilize static rinse tanks where feasible or switch to smaller tanks. Static rinse tanks work well for pre-wetting surfaces. Consider reusing static rinse water as make-up water.

- Use counter-current rinsing systems that flow water in the opposite direction of the process, leaving the last tank cleanest and the previous tanks requiring less water. Counter-current systems can reduce water use by 25 percent to 50 percent.

- Cover bath tanks when not in use to reduce evaporation losses.

- Install water-saving spray rinse or fog rinse systems where appropriate. Use the correct nozzles so that sprays and fogs are directed appropriately.

- Employ recirculation technology on reverse osmosis and deionized water systems. Operate filtration equipment properly to avoid producing excess reject wastewater.

A metal finishing plant in San Jose, Calif., installed air knives and flow restrictors and cut water use by 25 percent. They realized payback on the investment within two months.

Non-Contact Cooling Water Efficiency Practices

Non-contact cooling is the most common industrial water use practice. This process generally uses the largest amount of water at a facility. Processing machine, air compressor, refrigeration, steam condenser and air conditioning cooling systems are common in various industries and institutions. Employing efficiency practices addressing non-contact cooling water conservation achieves significant facility water savings.

- Retrofit or eliminate once-through cooling systems. Retrofits allow for recirculation of cooling water and can be adapted to some once-through systems. Install closed loop water/air heat exchangers or chillers or an evaporative cooling tower system for cooling water recycling.

- Replace water-cooled equipment with air-cooled.

- Install temperature control valves on equipment with recirculating cooling water, minimizing discharge to the water-cooling system.

- Use just enough water flow needed for adequate cooling.

- Install a timer to shut off the cooling tower when cooling is not needed.

- Reuse single-pass or cooling tower discharge in other applications.

- Properly operate and maintain evaporative cooling systems. Consider the following techniques for improving efficiency.

    - Install meters and monitor water use to ensure the tower is operating within recommended limits.

    - Reduce blow down and make-up flows by pre-treating the source water or applying in-line treatment techniques. Pre-treating the make-up water protects the system from excessive scale development and corrosion, and allows more cooling water cycles. Before conditioning the water with chemical additions, evaluate the chemical changes to the blow-down water and notify state and federal agencies. Discharge permits and additional wastewater treatment may be required.

      Pre-Treatment and In-Line Treatment Methods include: Side stream filtration, ozonation, ion exchange, chemical additions, pH adjustment, lime/soda softeners and oil and grease removal with detergent addition, separator or filter.

    - Cycle cooling water at least five times if possible without forming scale. Higher quality make-up water and chemical additions to control bacteria, algae, hardness and pH can make this possible.

    - Install meters that measure make-up and bleed off water conductivity and flow. Use the measurements to assess evaporation and drift losses and to optimize cooling system performance.

    - Maintain drift eliminators or install them if excessive drift exists.

Hot Water and Steam Systems Water Efficiency Practices

Heating systems heat water in boilers or hot water tanks for indoor heating, specific process heating, and steam electric generation. Water is lost from these systems by evaporation, blow-down and process consumption. Effective management minimizes losses, conserves water, reduces demands, and lowers energy costs.

- Properly operate and maintain boilers and employ water conservation techniques that include:
    - Returning steam condensate to the boiler.
    - Inspecting the system for leaks. Repair or replace corroded or worn parts promptly.
    - Treating boiler make up water with the same methods as evaporative cooling tower water. (See above) Minimize blow down by increasing the number of concentration cycles and pre-treat accordingly.
    - Discharging blowdown through an expansion tank for later.
    - Automating blowdown and make-up water controls to increase boiler efficiency.
- Insulate steam, condensate and hot water pipes and storage tanks to reduce heat losses.
- Install meters on blowdown and make-up lines.
- Maintain, inspect and repair steam traps and lines regularly.
- Utilize efficient heat exchanger designs and operate them according to the manufacturer/ installer's specifications.
- Install a hot water recovery system on hot water tanks.

Outdoor Water Efficiency Practices

The following water efficiency practices will help you save water in outdoor applications. See fact sheet WD-DWGB-26-3 "Water Efficiency Practices for Outdoor Water Use" for a more in-depth discussion.

- Underlay all turf grass areas with at least six inches of loam.
- Irrigate only when necessary or not at all.
- If you use automatic, pop-up sprinkler heads choose the type that incorporate electronic sensors to monitor soil moisture and rain events.
- Be sure sprinkler heads are producing drops rather than a mist. This helps reduce evaporation.
- Operate automatic sprinkler systems connected to public water systems only when the water demand is low, usually between 4 a.m. and 6 a.m.
- Irrigate before 9 a.m. to prevent evaporative water loss. Nighttime watering may promote bacterial and fungal growth.

- Don't water the pavement. Adjust sprinklers so that they water just the plants.

- Check your irrigation system, outdoor faucets and hose connections for leaks.

- For larger systems, develop an irrigation maintenance program. Routinely inspect all water lines, valves and pumps for leaks. Keep replacement and repair parts on hand. Inspect sprinkler nozzles to ensure they are operating properly and are distributing the water uniformly. Evaluate irrigation system pressures to better control application rates.

- Do not irrigate during windy conditions.

- Use mulch around shrubs, trees and other landscape plantings.

- Utilize drip or trickle irrigation wherever possible. These systems apply water near the root zone of the plant, ensuring a complete watering while eliminating excess water usage.

- Minimize turf area. Replace grass with mulched flowerbeds, gravel, wood chips, moss, or even a Zen garden. Consider xeriscaping. Xeriscape effectively utilizes drought tolerant vegetation that subsists on precipitation alone. Zen gardens traditionally contain no vegetation whatsoever, usually only raked sand, sculpture and a water feature. See fact sheet WD-DWGB-26-4 "Fundamentals of Xeriscape and Water Wise Landscaping."

- Plant drought-resistant turf grass. The most drought-tolerant grasses are the fine leaf fescues. Choose a mix that favors at least 50 percent fine leaf fescues. The University of New Hampshire Cooperative Extension recommends a mix containing hard fescue, Chewings fescue and perennial ryegrass. For more information visit the UNH Cooperative Extension's website at ceinfo.unh.edu/agtrfpub.htm, or contact John Roberts, the Extension Service lawn expert, directly at (603) 862-3202.

- Set your mower height to two inches. Longer grass blades retain moisture better, shade the root system, and encourage roots to grow deeper and stronger.

- Keep the mower blades sharp. Mowing with a dull blade gives grass a "split ends" look making it seem drier than it is.

- Plant local species. Native plants are hardier and tend to need less water. Check with your county co-operative extension for recommended native plantings. See ceinfo.unh.edu/Office.htm for a complete listing of UNH county extension services and contacts.

By installing a closed loop non-contact cooling system, New Hampshire Ball Bearings Inc. in Peterborough reduced its water demand by approximately 65,000 gpd. It also incorporated a membrane ultra-filtration system to treat process wash water for reuse. This system shows an average water savings of 1,813 gallons per month.

For Additional Information

Please contact the Drinking Water and Groundwater Bureau at (603) 271-2513 or dwgbinfo@des.state.nh.us or visit our website at www.des.nh.gov/dwgb. All of the bureau's fact sheets are on-line at www.des.nh.gov/dwg.htm.

US EPA. Listing of industrial water efficiency measures. www.epa.gov/owm/industip.htm

Cranfield University, England. Technical paper on in-house recycling and wastewater treatment. Other papers are available at this site, all highly technical.
www.cranfield.ac.uk/sims/water/finalreportin-inbuilding.doc

Cooling Tower Institute. Listing of technical papers related to water reuse and recycling that may be purchased from this site. Most papers cost $5.
www.cti.org/frame.html?page=http://www.cti.org/cgi-bin/download.cgi

References:

_____, *MRI Water Conservation Technical Bulletin #4, Water Conservation Best Management Practices Cleaning Processes*; New England Interstate Water Pollution Control Commission, Wilmington, MA; 1996.
_____, *MRI Water Conservation Technical Bulletin #9, Water Conservation Best Management Practices for Non-Contact Cooling and Heating Processes*; New England Interstate Water Pollution Control Commission, Wilmington, MA; 1996.
_____; *MIL-Handbook-1165, Water Conservation*; US Dept. of Defense; 1997; pp 38-49.
Vickers, Amy; *Handbook of Water Use and Conservation*; WaterPlow Press, Amherst, MA; 2001; pp 258-263, 288-303, 309-312.